

## Dual-Phase Inorganic Membrane for High Temperature Carbon Dioxide Separation

Jerry Y. S. Lin  
S. Chung  
R. Xiong  
H. Alsyouri

University of Cincinnati  
Department of Chemical Engineering  
Cincinnati, OH 45221-0171

Phone: (513)556-2761  
Fax: (513)556-3473  
Email: jlin@alpha.che.uc.edu

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### Abstract

This study is focused on synthesis and property study of inorganic dual-phase (metal and molten carbonate) membrane for separation of carbon dioxide at high temperatures. Our main goals are to obtain a membrane with carbon dioxide permeance of  $1-5 \times 10^{-7}$  mol/m<sup>2</sup> · S · Pa and carbon dioxide to nitrogen selectivity up to 100 at high temperatures (400-600°C). Dense dual-phase membrane was synthesized by a direct infiltration method with macroporous metal substrate and Li/Na/K carbonate mixture. Helium permeation measurements with a rubber seal at room temperature show that the helium permeance of the metal membrane decreased by 5 orders of magnitude after infiltration of the molten carbonate. Only carbon dioxide in the ionic form can permeate through the membrane. The more gas-tight the membrane is, the more permselective it is to carbon dioxide from gas mixture. A high temperature permeation/separation system was set up and a membrane cell with an oxidation resistant graphite gasket seal was tested. The new oxidation resistant grade graphite seal showed better gas-tightness (by one order of magnitude in terms of helium permeance) than the normal grade graphite seal at high temperatures (400-500°C). Experiments are being conducted to test permeation and separation properties for carbon dioxide on the dual-phase membrane samples that were prepared. The results of the permeation/separation experiments will provide feedback for optimization of the membrane synthesis.

**List of Publications/Presentations (DE-FG26-00NT41555)**

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S. Chung, R. Xiong, H. Alsyouri